Case study

Title: Management of Pulpally Involved Primary Teeth With Triple Antibiotic Paste – Review and Case Series

ABSTRACT

Root canal treatments are considered as one of the most important therapies in dentistry as they involve in maintaining and preserving the tooth along with its function up to a permissible extent. The root canal system exhibits different as well as complicated anatomical considerations. The necrotic pulp tissue remaining in the canal decreases the effects of root canal irrigants and medicaments and thereby will interfere with the proper and subsequent adaptation of root canal fillings to the dentinal surface. Taking into consideration these consequences, certain modified disinfection and irrigation procedures are required to remove the remaining tissues from the root canal area thoroughly and also to eliminate the microorganisms present within the canal. Odontogenic infections anchor a huge number of highly potent microorganisms, therefore to counteract this infection, various drug combinations particularly antibiotics are needed to combat the micro biota responsible for creating these lesions. Over time as an adjunct to the conventional clinical procedures, antibiotics have begun to enlighten their prime significance. Several antibiotics have been investigated and used to control the dental infections. Triple antibiotic paste (TAP) containing metronidazole, ciprofloxacin and minocycline has been proposed as a root canal medicament due to its highly proven antimicrobial effects in endodontic regenerative procedures. However this combination had been modified in later years to reduce its associated side effects.

Key Words: Triple Antibiotic Paste, Odontogenic infections, Root canal irrigants.

INTRODUCTION

Infections of pulp and periapical region is predominantly established by the presence of bacteria within the root canal system. Pulpal infections occur at a rapid rate in primary teeth when compared with permanent teeth due to the pertaining morphological and structural differences between both. The enamel layer of deciduous teeth is thinner than its permanent counterpart. The conventional treatment options for pulpally affected teeth will be multi-visit pulpectomy with stainless steel crown (SSC) or extraction followed by a space maintainer. [1] However, pediatric dentists prefer pulpectomy than extractions considering the innumerable benefits of preserving deciduous teeth. But several unconditional factors makes the conventional pulpectomy procedures arduous. The long procedural time taken to effectively complete the procedure will possess as a challenge to the cooperative ability of a child. Second, pulpectomy of abscessed teeth often requires multiple visits with supportive antibiotic therapy. It has been proven that mechanical instrumentation alone is not sufficient in making a bacteria-free environment in canal system [2]. There are various in vivo and in vitro studies which confirm the inefficiency of mere mechanical instrumentation to prepare all portions of root canal walls thoroughly and complete elimination of microorganisms [3].Several well augmented disinfection procedures are required to eliminate microorganisms and their toxins from the root canal system [4]. A suitable material of choice for this would be antibiotics. Thus to overcome these problems the concept of lesion sterilization and tissue repair (LSTR) was introduced which involved the topical placement of triple antibiotic pastes (TAPs) thus aiming to disinfect the canal space and thereby promoting tissue repair. [4]

REVIEW

The complete elimination of microorganisms from the infected root canal is a complex procedure requiring utmost precision and time consumption. Several methods have been evaluated which showed a decline in these microbial colonies. The primary aim of endodontic treatments is to completely eliminate all possible microorganisms from the root canal system and create a favorable sterile environment. This is achieved through the use of aseptic treatment strategies, chemo-mechanical preparation, thorough antimicrobial irrigation, and with suitable intracanal medicaments. Nearly 50-60% of root canal peripherals and ramifications remain uninstrumented. In this existing scenario the remaining infected or necrotic pulpal tissues act as the major nutrition source for the remaining microorganisms in the canal. Hence this can be reduced or eliminated by mechanical instrumentation, thorough irrigation of canals, and placement of medication. Conventionally calcium hydroxide has been used as an intracanal medicament in a tooth with open apex and necrotic pulp for inducing a bridge formation. In the recent era combination of antibiotics, called 'triple antibiotic paste' (TAP) was introduced especially for the regeneration, revascularization and the treatment of open apex teeth with necrotic pulp. This material has shown several other applications in endodontics

Indications for lesion sterilization and tissue repair

1. Primary teeth affected with pain and tender on percussion.
2. Teeth with Grade I and II mobility.
3. Presence of abscess.
4. Presence of sinus tract.
5. Presence of radiolucency in furcation area.

6. Pulpless primary teeth in hemophilic patient.

7. Immature primary teeth with necrotic pulp and incompletely formed roots.

Contraindications

1. Patient sensitive or allergic to ciprofloxacin, minocycline, or metronidazole.

2. Radiographic evidence of excessive internal or external root resorption.

3. Primary tooth nearing exfoliation.

4. Perforated pulpal floor.

5. Excessive bone loss in furcation area involving underlying tooth germ.

6. Non restorable crown of permanent tooth where post placement and core buildup are not possible.

Applications of triple antibiotic paste

1. Regeneration and revascularization of pulp.
2. Intracanal medicament for the treatment of periapical lesions, external inflammatory root resorption, root fracture and primary teeth.
3. Intracanal agent in flare-up cases.
4. Medicated sealer (to prevent possible re-infection)
5. An additive to gutta-percha points in root canal obturation (known as medicated gutta-percha points)

Biocompatibility of TAP

The study conducted by Ruparel *et al*. evaluated that the rate of survival of human stem cells of the apical papilla (SCAP) after exposure to different dilutions of TAP showed that, in a clinical situation, a 1000 mg/mL solution is necessary to create pasty slurry for antibiotic pastes. The

current clinical situations could be risky for the survival of SCAP cells during TAP dressing and consequently to the ultimate result of dentin-pulp regeneration. [5]

The clinical procedure

Isolation the tooth with rubber dam followed by administration of local anesthetic agent. The access cavity is then prepared following caries removal and pulp extirpation is done subsequently.

The cavity is then irrigated with normal saline (0.9%) and dried with cotton pellet. After adequate enlargement of canal orifices the cavity is then filled with triple antibiotic mix and teeth restored with glass ionomer cement, and stainless steel crown is placed.

Method of preparation

The antibiotic paste should be freshly prepared and a clean mortar pestle is used for mixing. The three antibiotics ciprofloxacin, metronidazole, and minocycline powder are dispensed and mixed with a ratio of 1:3:3.Then, equal amount of propylene glycol is added to forma creamy paste. Extra paste can be stored in air‐ tight container for future use. However, the loss of translucency of the paste indicates contamination and it should be discarded. A 20 gauge needle or lentulospirals is placed 1–2 mm short of root apex and medicaments are introduced into the canal using a backfill approach. [5]

Triple antibiotic paste removal

The appropriate method for TAP removal is by thorough irrigation and sufficient instrumentation. Complete removal of TAP cannot be achieved by this photon-induced acoustic streaming. Ultrasonic activation is one such widely applied techniques which has given effective results in the removal of TAP from the root canals. [5]

CASE REPORT-1

A 5-year old girl reported to the department with the chief complaint of pain in lower right second deciduous molar tooth. The child complained of pain during mastication. The child did not exhibit any history of swelling or fever. On clinical and radiographic examination it was found that this tooth had dislodged restoration and was tender on percussion. Radiographic examination revealed internal root resorption. The diagnosis of chronic irreversible pulpitis with internal root resorption was made. All the conventional treatment modalities of pulpectomy and extraction of tooth followed by space maintainer was discussed. However the treatment plan was finalized with the decision of carrying out pulpotomy with placement of Triple Antibiotic Paste was decided as taking in consideration of child's age and in an attempt of preserving the tooth till its normal exfoliation time.

The child was administered with local anesthesia, Lidocaine 2% with 1:100,000 epinephrine (DENTSPLY, College Ave, York, PA, USA).Following local anaesthesia, the remains of dislodged restoration and caries were removed and the pulp chamber access was obtained. A #10 K-file with RC Prep (Premier, Philadelphia, USA) was used to slowly scout the coronal 5mm of the canals. Following which irrigation was thoroughly performed with 1% sodium hypochlorite. Triple Antibiotic Paste was mixed to a ratio of 1:3:3 (minocycline, metronidazole and ciprofloxacin) with propylene-glycol as a carrier. The mixture was placed on the pulpal floor and at the canal orifices. A final restoration was placed with a layer of GIC. This was followed by review after 1 month and 3 months, following healing of the lesion placement of stainless steel crown on 85 was done after three months (Figure. 1-4). Oral hygiene instructions and diet counselling were given to parents. Recall visits for regular

Figure. 1: Preoperative

Figure. 2: Postoperative

Figure. 3: 1 month follow-up

checkup to assess the oral status of the child was scheduled every 6 months.

Figure. 4: 3- month follow-up

CASE REPORT-2

A 4-year old boy reported to the department with the chief complaint of pain on upper left back teeth region. The child did not exhibit any history of swelling or fever. On clinical and radiographic examination it was found that these teeth were slightly mobile and tender on percussion. Radiographic examination revealed internal root resorption. The diagnosis of chronic irreversible pulpitis with internal root resorption was made irt to upper left first and

second deciduous molar teeth. The treatment plan was finalized with the decision of carrying out pulpotomy with placement of Triple Antibiotic Paste was decided as taking in consideration of child's age and in an attempt of preserving the tooth till its normal exfoliation time.

The child was administered with local anesthesia, Lidocaine 2% with 1:100,000 epinephrine (DENTSPLY, College Ave, York, PA, USA). Following local anaesthesia, the caries were removed and the pulp chamber access was obtained. A #10 K-file with RC Prep (Premier, Philadelphia, USA) was used to slowly scout the coronal 5mm of the canals. Following which irrigation was thoroughly performed with 1% sodium hypochlorite. Triple Antibiotic Paste was mixed to a ratio of 1:3:3 (minocycline, metronidazole and ciprofloxacin) with propylene-glycol as a carrier. The mixture was placed on the pulpal floor and at the canal orifices of both the teeth. A final restoration was placed with a layer of GIC. This was followed by review after 1 month, persistent healing of the lesion placement of stainless steel crown on 64 and 65 was done after three months. Fluoride application was done (Figure. 5-6).

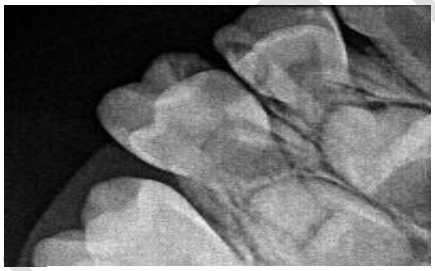

Figure. 5: Preoperative

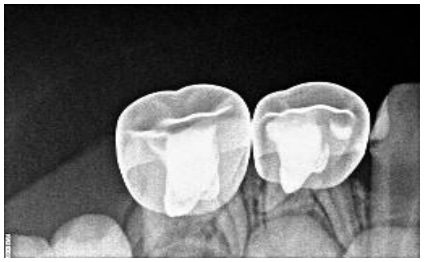

Figure. 6: 3- month follow-up

CASE REPORT -3

A 7-year old boy reported to the department with the chief complaint of pain on lower right back tooth. On clinical and radiographic examination it was found that the tooth was tender on percussion. Radiographic examination revealed mild internal root resorption. The diagnosis of chronic irreversible pulpitis with internal root resorption was made in relation to

lower right deciduous second molar tooth. The treatment plan was finalized with the decision of carrying out pulpotomy with placement of Triple Antibiotic Paste in an attempt of preserving the tooth till its normal exfoliation time.

The child was administered with local anesthesia, Lidocaine 2% with 1:100,000 epinephrine (DENTSPLY, College Ave, York, PA, USA). Following local anaesthesia, the caries were removed and the pulp chamber access was obtained. After coronal preparation with a#10 K-file irrigation was thoroughly performed with 1% sodium hypochlorite. Triple Antibiotic Paste was mixed to a ratio of 1:3:3 (minocycline, metronidazole and ciprofloxacin) with propylene-glycol as a carrier. The mixture was placed on the pulpal floor and at the canal orifices of the tooth. A final restoration was placed with a layer of GIC. After healing of the lesion stainless crown was placed three months after review (Figure. 7-9).

Figure. 7: Preoperative

Figure. 8: Postoperative

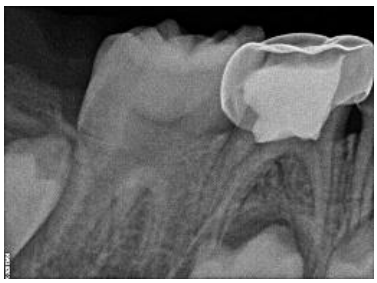

Figure. 9: 3- month follow-up

DISCUSSION

LSTR is an acronym for lesion sterilization and tissue repair. In this method a combination of antibiotics (metronidazole, ciprofloxacin, and minocycline) which are used for controlling of oral infections such as dentinal, pulpal, and periapical lesions. All the three tablets are powdered and

the contents are mixed to a paste with propylene glycol acting as a carrier. [6] The triple antibiotic paste (TAP) contains 1 part of ciprofloxacin and 3 parts of metronidazole and 3 parts of minocycline by weight. Ciprofloxacin is a synthetic fluoroquinolone and has a bactericidal effect. Metronidazole is a broad spectrum nitroimidazole compound active against protozoa and other anaerobic microgranisms. The third drug minocycline is a synthetic derivative of tetracycline with a similar spectrum of action as that of tetracycline. This recent technique of disinfecting the developed oral lesion was invented by the Cariology Research Unit of Nigata University School of Dentistry. [6] The important uses of TAP includes pulp regeneration and revascularization of young permanent teeth. In primary teeth a permanent restoration is usually placed in the same visit once the triple antibiotic paste is applied at the canal orifices or introduced into the root canals. [7] The wide spectrum antibacterial activity of Metronidazole due gained its inclusion as the 1st choice drug for triple antibiotic paste preparation. [7] Metronidazole binds to the DNA and disrupts its helical structure and thus leads to rapid cell death. The two other antibacterial drugs, i.e. ciprofloxacin, and minocycline, (3MIX) were added in an effort to eliminate all bacteria. The 2nd choice of drug ciprofloxacin is a synthetic fluoroquinolone with rapid bactericidal action and inhibits DNA gyrase of bacteria. It exhibits very potent activity against Gram-negative bacteria. Minocycline is a semisynthetic derivative of tetracycline, primarily bacteriostatic, inhibiting protein synthesis by binding to 30S ribosomes in susceptible organisms and exhibits broad spectrum activity, however it has got few side effects including tooth discoloration. [7]

TAP shown to be highly efficient and systematically effective when utilized for pulpal treatment of chronically infected deciduous dentition. Results of 12-month clinical studies comparing conventional pulpectomy procedures to triple antibiotic paste based pulpotomies found that the

success rate of these two procedures are comparatively similar. [8] The clinical success rates of TAP pulpotomies and conventional pulpectomies were 100% and 96% respectively which were calculated at systematic interval time periods of both six and 12-month intervals. [9] A recent study comparing two different methods of performing TAP pulpotomies showed success with either method, with instrumentation of the coronal pulp being more successful than the non-instrumentation group. [10] Replacement of minocycline with clindamycin or doxycycline can overcome this problem. Furthermore, some scientists advocated use of dentin- bonding agent before placement of triple antibiotic paste to reduced discoloration.

CONCLUSION

Endodontic treatments rely mainly upon the elimination of the involved micro biota from the root canal system. Biomechanical instrumentation does not always provide such an environment in the root canal system. Non-instrumentation methods strategies including regeneration and revascularization of the pulp should be considered especially with antibiotics. Amongst the various combination of antibiotics TAP, owing to its effectiveness on different microorganisms and its diverse applications and triumphs, is of particular interest in endodontics.

The conducted studies till date clearly defines that TAP can be effectively and efficiently used for root canal sterilization and peariapical healing in cases of an existing pathological condition. The ability of TAP in managing non-vital young permanent tooth is based on the viable stem cells that are present. Pertaining to the possible draw backs of development of resistant bacterial strains and tooth discoloration TAP appears to be an efficacious material of choice in endodontic therapy.

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